SECTION 20 30 13

VIBRATION ISOLATION AND SEISMIC CONTROL FOR FACILITY SERVICES

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. Vibration isolation devices

B. Supports

C. Plumbing and HVAC piping vibration dampeners

D. Seismic control restraints

E. Seismic control for piping

F. Seismic control for ductwork

G. Vibration insulation

1.02 RELATED SECTIONS

A. Basic mechanical materials and methods are specified in Section 20 10 13, Common Materials and Methods for Facility Services – Fire Suppression, Plumbing and HVAC.

1.03 MEASUREMENT AND PAYMENT

A. Separate measurement or payment will not be made for the work required under this Section. All costs in connection with the Work specified herein will be considered to be included or incidental to the Work of this Contract.

1.04 REFERENCES

A. American Society of Heating, Refrigerating, and Air Conditioning Engineers (ASHRAE):

1. ASHRAE Handbook, HVAC Systems and Equipment

2. ASHRAE Handbook, HVAC Applications

B. National Fire Protection Association (NFPA):

1. NFPA 90A Standard for the Installation of Air Conditioning and Ventilating Systems

C. Sheet Metal and Air Conditioning Contractors National Association Inc. (SMACNA):

1. SMACNA Seismic Restraint Manual Guidelines for Mechanical Systems

2. SMACNA Duct Construction Standards - Metal and Flexible

1.05 SUBMITTALS

A. General: Refer to Section 01 33 00, Submittal Procedures, and Section 01 33 23, Shop Drawings, Product Data, and Samples, for submittal requirements and procedures.

B. Shop Drawings: Submit Shop Drawings showing isolator types and sizes, locations with static and dynamic load on each location, and installation details, including recording and alarm device wiring and control diagrams where required.

C. Product Data: Submit manufacturer's product data and certificates of compliance for each type of vibration control product provided.

D. Maintenance Data: Submit maintenance data for each type of vibration control product, and include in maintenance manual specified in Section 01 78 23, Operation and Maintenance Data.

E. Seismic Calculations: Submit seismic calculations on all equipment, ductwork and piping restraints, anchors and supports. Calculations shall be prepared by a civil or structural engineer currently registered in the State of California and shall conform to BART Facilities Standards Structural-Seismic Design Criteria.

F. Measured Equipment Deflections: Upon completion of vibration control work, prepare a report showing measured device deflections for each major item of equipment indicated.

1.06 MANUFACTURER RESPONSIBILITIES

A. The Contractor shall arrange with the manufacturers of the vibration isolation and seismic control devices to provide the following services along with the specified equipment and control devices:

1. Determine vibration isolation and seismic restraint device sizes and locations.

2. Provide piping, ductwork and equipment isolation systems, and seismic control systems as indicated.

3. Guarantee specified isolation system deflection.

4. Provide installation instructions and drawings.

5. Provide resilient restraining devices as required to limit equipment and piping motion in excess of one fourth inch as approved by the Engineer.

6. Calculations of seismic loading and design for seismic conditions shall be in accordance with applicable referenced standards and BART Facilities Standards Structural-Seismic Design Criteria.

1.07 QUALITY ASSURANCE

A. The determination of static, dynamic, and seismic loadings and the design of brackets, supports, connections, restraints and other structural elements shall be performed by a civil or structural engineer currently registered in the State of California.

B. The Contractor shall arrange with the manufacturer to provide field services in accordance with the requirements of Section 01 43 00, Quality Assurance.

PART 2 – PRODUCTS

2.01 VIBRATION ISOLATION DEVICES

A. Provide vibration isolation devices for limiting transmittance of vibration from vibration-producing equipment to the structure on which it is supported or attached. Isolate piping and ductwork from rotating equipment with flexible connections.

B. Provide the types of vibration isolation devices as recommended by the respective mechanical equipment manufacturers, to isolate vibrations for each particular piece of equipment.

C. Provide vibration isolation devices consisting of standard rubber pads or one half inch thick neoprene rubber pads between the mounting feet or bracket and the support surface for the following items:

1. Fans and air handling units, roof type unit;
2. Condensing units;
3. Unit heaters;
4. Pumps;
5. Air compressors;
6. Emergency generators;
7. Elevator motors, motor generators, dc power converters, and hydraulic power units; and
8. Electrical equipment containing reactors or choppers.

D. Provide spring isolators and inertia pads for fans, pumps, and other vibrating equipment, that is located, directly above or adjacent to an occupied area. Provide rubber pads one half inch thick between the spring foot and the support surface. Spring isolators shall be the seismic restraining type.

E. Isolator types, base types, and minimum static deflection shall be in accordance with ASHRAE Handbook, HVAC Applications, and Chapter 43. Vibration Isolator Selection guide, unless otherwise indicated.

2.02 SUPPORTS

A. Concrete Bases: Ventilation fans of 25 hp or greater or engine generators of 300 hp or greater shall be mounted on concrete inertia bases (pads) with isolation units to support equipment. Provide rectangular structural beam channel or complete sheet metal box forms for floating foundations. Provide frame unit as indicated, or if not indicated, provide frame with minimum depth of six inches. Provide reinforcing both horizontally and longitudinally butt welded to the base framing.

B. Equipment Frames:

1. Provide mounting frames and brackets for fans, pumps, and compressors to carry the load of the equipment without causing mechanical distortion or stress to the equipment.

2. For wide flange structural steel frames with brackets, the maximum allowable deflection of any point on the loaded frame relative to the unloaded frame is 0.005 inch. A wide flange section with a depth greater than one tenth of the length of the longest frame member is acceptable for satisfying deflection requirements.

3. For channel structural steel frames with four-point support, the section depth requirement is the same as that specified above in Article 2.02.B.2.

2.03 PLUMBING AND HVAC PIPING VIBRATION DAMPENERS

A. Type 1: Closed spring hanger with one-inch thick acoustic isolator.

B. Type 2: Elastomer mount with threaded insert and hold down holes.

C. Type 3: Trisolators - Steel metal sleeve with felt insert to be installed at attachment points of hangers or piping.

2.04 SEISMIC CONTROL RESTRAINTS

A. Requirements:

1. Restraints shall permit adjustment during installation to ensure sufficient clearance between vibration isolated element and rigid restraining device.

2. A restraint shall not be installed until vibration isolators have been loaded and adjusted to achieve the specified static deflection and clearance.

3. Restraints at base supported equipment shall include resilient neoprene pads at all potential contact areas between isolated equipment and rigid restraining element.

B. Description:

1. Restraining devices at all base supported vibration isolated equipment may be separate components sized and installed to meet the requirements specified or may be built into vibration isolation mounts.

2. Piping to vibration-isolated equipment shall have vibration isolation joints and isolator type seismic restraints. The isolator type seismic restraints shall, as a minimum, consist of steel rods, three eighths inch minimum diameter together with neoprene snubbers arranged to achieve the required all-directional restraint anchored and sized to resist the seismic forces as specified above. Shop Drawings shall indicate proposed method for achieving vertical restraint for ceiling suspended piping. Rods shall have sufficient slack to avoid short-circuiting the vibration isolators.

2.05 SEISMIC CONTROL FOR PIPING

A. Longitudinal and transverse seismic bracing of all piping, including plumbing piping, fire protection piping, sewer piping, and storm drain piping, shall be installed in accordance with Section 20 20 13, Pipe Sleeves, Supports, and Anchors for Facility Services.

2.06 SEISMIC CONTROL FOR DUCTWORK

A. Longitudinal and transverse seismic bracing of all ductwork shall be installed in accordance with SMACNA Seismic Restraint Manual Guidelines for Mechanical Systems and ASHRAE Handbook, HVAC Applications, Chapter 50, except that the design of restraints shall be based on a force equal to 100 percent of the weight of the ductwork acting in either direction.

2.07 VIBRATION ISOLATION

A. All piping, electrical conduit, and ductwork shall be isolated from the equipment to which they are attached.

B. Ductwork isolation shall be by means of physical three-inch gap with flexible fabric connections furnished and installed in accordance with SMACNA Duct Construction Standards - Metal and Flexible and ASHRAE Handbook, HVAC Systems and Equipment, Chapter 16. Flexible fabric connections shall conform to NFPA 90A. Fabric shall be unpainted glass fiber cloth weighing not less than 32 ounces per square yard. Cloth shall be coated with fire-resistant neoprene on both sides. Flexible portion shall be six-inches long. Perimeter connection on each end shall be three-inch-wide galvanized sheet steel, and shall be mechanically bonded to the fabric. Fasteners shall be either screws or bolts. Flexible connectors shall be mechanically secured, at both ends, to provide airtight joints.

C. Piping isolation shall be by means of flexible connector furnished as follows:

1. For system pressure of 60 to 250 psig: Provide stainless steel below hose assembly complete with bellows with stainless steel woven wire mesh jacket and

stainless steel nipple ends, threaded for piping two inches and smaller, flanged, 250 pounds for piping two and a half inches and larger. The bellow hose assembly shall be rated for 450 pounds operating pressure at 120 degrees Fahrenheit.

2. For system pressure less than 60 psig: Provide woven nylon or polymer reinforced neoprene or BUNA A corrugated or bellows-type flexible connector with integral flanges, 125-pound drilling. Unit shall be rated for minimum 125-pound drilling. Unit shall be rated for minimum 125 psig operating pressure.

3. For refrigerant lines: Provide stainless steel or copper bellows assembly with woven stainless steel wire mesh jackets rated for refrigerant service, 12-inch minimum length overall.

4. For electrical conduit: Provide three-foot length seal tight flexible conduit in accordance with applicable requirements of the California Electrical Code.

PART 3 – EXECUTION

3.01 INSPECTION

A. Examine location and installation conditions where vibration-control units are indicated to be installed. Do not proceed with work until unsatisfactory conditions, if any, have been corrected.

3.02 PERFORMANCE OF ISOLATORS

A. Comply with minimum static deflections recommended by ASHRAE referenced standards for selection and application of vibration isolation materials and units as indicated.

B. Except as otherwise indicated, comply with manufacturer's instructions and recommendations for selection and application of vibration isolation materials and devices.

3.03 APPLICATIONS

A. Product Selection: Except as otherwise indicated, select vibration control products as specified in Article 2.01. Where more than one type of product is offered that meet specified requirements, the selection is the installer's option.

B. Piping: For piping connected to equipment mounted on vibration control products, install isolation hangers as indicated that provide static deflection of the first point to be twice the deflection of the isolated equipment and as follows:

1. For the first three points of support for pipe sizes four inches and smaller.

2. For the first four points of support for pipe sizes five inches through eight inches.

3. For the first six points of support for pipe sizes 10 inches and larger.

C. Seismic Control Restraints: Provide seismic restraints in accordance with referenced SMACNA Seismic Restraint Manual Guidelines for Mechanical Systems.

3.04 INSTALLATION

A. Install vibration isolation and seismic restraint devices as indicated. Provide for installation on a level base.

B. Set steel bases for one-inch clearance between housekeeping pad and base. Adjust equipment level.

C. Use an anchor-bolt location template for proper alignment between concrete pad, anchor base, vibration isolation device, and bolt holes on base of apparatus being supported. Provide anchor bolts with washers and hex nuts Torque nuts to manufacturer's recommended setting.

D. Schedule of Piping Isolators:

1. Horizontal lines, four inches and larger: Spring hanger, Type 2, nominal two inches static deflection.

2. Horizontal lines, two inches to four inches: Spring hanger, Type 1, nominal one-inch static deflection. Hanger boxes shall be mounted directly against building structural members, and not on slab diaphragm.

3. Horizontal lines, one half inch to one and a half inches: Type 3 Trisolator sleeves with felt insert in sheet metal jacket.

4. Vertical risers, pipe clamp with applicable isolators: Single point of support shall be provided for risers greater than four inches in diameter at highest point. Guide at midpoints of riser shall be provided with neoprene mounts. Submit detail of guide and support.

5. Pipe anchors, vertical or horizontal: Resilient anchor points shall be installed in piping to provide a neutral point for expansion and contraction of piping without direct contact of piping with building structure.

E. Where anchor bolts pass through the rubber support pads, provide a neoprene rubber sleeve and washer to separate the anchor bolt shank and head (or nut) from the machine support foot or bracket.

F. Provide a pair of neoprene side snubbers or restraining springs where side torque or thrust may develop.

3.05 ADJUSTING AND CLEANING

A. Clean each vibration and seismic control unit, and verify that each is working freely and that there is no dirt or debris in the immediate vicinity that could possibly short-circuit unit isolation.

3.06 START-UP

A. Before start-up of equipment, check level of equipment or apparatus as required. Start up and check for proper deflection of vibration isolation devices. Make necessary adjustments.

END OF SECTION 20 30 13